Antioxidant, Anti-inflammatory and Radioprotective Potential of Phycocyanin from Spirulina platensis.

Synopsis of Ph.D. Proposal

Submitted by

Mrs. Vaishali Nitin Wadekar.

Under the guidance of

Prof. C. N. Khobragade.

Head
Department of Biotechnology
Swami Ramanand Teerth Marathwada University, Nanded.

Antioxidant, Anti-inflammatory and Radioprotective Potential of Phycocyanin from Spirulina platensis.

Abstract of Proposed Work

Introduction :

Oxidative stress is an unavoidable phenomenon in living cells. Being a part of an aerobic life oxygen is an indispensable element having important role but is also responsible for formation of highly reactive oxygen species that are toxic to cell.

Numerous exogenous and endogenous sources are known for the production of ROS(Reactive Oxygen Species) & RNS (Reactive Nitrogen Species) in living cells. Endogenous sources are enlisted as, mitochondria, peroxisomes, inflammatory cells & cytochromes p450 metabolism etc. Mitochondria are the major contributor of the ROS generation in respiring cells.

Exogenous sources viz. Ionizing Radiations from different sources including solar & cosmic radiations, electromagnetic waves, high energy particles from natural radioactive elements as well as manmade sources such as , x-ray tubes, nuclear reactor , particle accelerator, nuclear warfare, therapeutic radiations as a part radiotherapy and radio diagnostic methods are the means of interactions of radiation with the living system.

There are numerous mechanism are evolved to tackle the oxidative stress in living cells. Some are the natural antioxidants that combating with the free radical either scavenging them or acting as a mitigators that zap free radicals by combating with them.

The Radioprotectors from herbs are more effective than the chemical radioprotector as they are not having deleterious side effects. Biochemical, toxicological and clinical evidences support the use of different natural products as adjunct treatment for patients exposed to radiation during radiotherapy.

An ideal radioprotector should have one or more of the following properties as,

1. Free radical scavenging
2. Reduce oxidative damage
3. Facilitate DNA & cellular repair
4. It must be a Immunomodulator.
5. Facilitate repopulation of damaged affected organs.

Practically it should offer good protection against both acute & chronic radiation damage easily administrable, easily distributed throughout the body should not be toxic, easy handling and storage readily available & inexpensive .

Review of literature & development in the Subject :

A variety of marine algae have been explored for the compounds having antioxidant , anti- inflammatory and radioprotective potentials.

Phycocyanin (PC) is a phycobiliprotein that has been reported to exhibit a variety of pharmacological properties.

Phycobiliproteins are a small group of highly conversed chromoprotein that constitute the phycobilisome , a macromolecular protein complex, that serve as a light harvesting complex for the photosynthetic apparatus of cyanobacteria & eukaryotic group.

Most common class of of phycobiliproteins are allophycocyanin, phycocyanin & phycoerythrin, all of which are formed by α &β protein subunits & carry different isomeric linear tetrapyrrole prosthetic groups which differs in the arrangement of their double bonds. The bilin groups are attached to the polypeptide through thioether linkages to specific cysteinyl residues.

Objectives of Research / Proposed Hypothesis :

1. Collection, Identification and Cultivation of Spirulina platensis .
2. Quantitative Analysis of Spirulina platensis.
3. Characterization of Phycocyanin from Spirulina platensis.
4. Assessment of Antioxidant activity of Phycocyanin from Spirulina platensis. in vitro.
5. Assessment of Antioxidant Activity of Phycocyanin from Spirulina platensis in vivo.
6. Assessment of Anti-inflammatory activity of phycocyanin in vitro.
7. Assessment of Anti-inflammatory activity of phycocyanin in vivo.
8. Assessment of Radioprotective potential of phycocyanin .

Methodology to be adopted:

- **Collection , Identification and Cultivation of Spirulina platensis .**

- **Methods for Isolation & Characterization of Phycocyanin :**
  1. Cultivation of Spirulina platensis
  2. Extraction of Phycocyanin from the cultured Spirulina platensis.
  3. Partial purification of Phycocyanin by dialysis
  5 . Purification of Phycocyanin by affinity chromatography.
  6. Spectroscopic characterization of phycocyanin.

- **Antioxidant Assay Invitro:**
  DPPH Antioxidant assay

- **Antioxidant Assay In vivo: (Any two of the following)**
  1. Glutathione Peroxidase assay (GPx)
  2. Superoxide Dismutase assay (SOD)
  3. Alkaline Phosphatase Assay (ALP) / Alkaline Aminotransferase(ALT)
     To check liver damage & protection
  4. Lipid Peroxidation (LPO) Assay

- **Anti-inflammatory Studies :**
  Cox1& Cox 2 enzymatic assays

- **Assessment of Radioprotective Potential:**
  1.Radioprotective potential at molecular level
  2. Radioprotective potential at cellular level

Proposed work Plan/Formulation and Structure of Study

- **Year 1 :**
  - **Collection , Identification and Cultivation of Spirulina platensis.**

  - **Isolation & Characterization of Phycocyanin**

1. Cultivation of Spirulina platensis
2. Quantitative analysis of Spirulina platensis.
2. Extraction of Phycocyanin from the cultured Spirulina platensis.
3. Partial purification of Phycocyanin by dialysis
5. Purification of Phycocyanin by affinity chromatography.
6. Spectroscopic characterization of phycocyanin.

  - **Invitro Antioxidant Assay:**

DPPH Antioxidant assay

- **Year 2:**
  - **In vivo Antioxidant Assay:**

1. Glutathione Peroxidase assay (GPx)
2. Superoxide Dismutase assay (SOD)
3. Lipid Peroxidation (LPO) Assay

Anti-inflammatory Studies :

Cox1& Cox 2 enzymatic assays

- **Year 3 :**
  - **Radioprotective Studies:**

1.Radioprotective studies at molecular level
2. Radioprotective studies at cellular level

Importance of Study :

- **National & International Status :**

Various algae & cyanobacteria have been screened for a variety of pharmaceutically important bioactive compounds including phenolics, flavonoid, tannin & c-phycocyanin.

Marine algae are considered as a rich source of biofunctional metabolites with potential health benefits. Algae metabolites have been widely explored for radioprotective effects & among these natural products, polysaccharides & polyphenolic compounds have occupied the leading position with a considerable number of pharmaceuticals and drugs.

- **Significance of the Study :**

A search for a good herbal radioprotector is a prime important. Synthetic & chemical radioprotector which are given to the cancer patients during radiotherapy are having numerous side effects. The herbal radioprotector can be a good replacement with no or less side effects. Hence search for herbal radioprotection is significant.

References:

1.B.N.Popov,S.Y.Georgieva,S.Lalchev, Radioprotection from genetic damage by resurrection plant haberlea rhodopensis- in vivo/in vitro study with rabbits;Trakia Journal of Sciences, 2012,vol 10,no 3,pp41-47.

2. Jae-Young Oh, I.P.Shanura Fernando and You-Jin Jeon;Potential application of radioprotective phytochemicals from marine algae; Algae2016,31(4);403-414.

3. Zi-Leun Fan,Zhen-Yu-Wang,Li-Li Zuo, Shuang-Qi Tian;Protective Effect of Anthocyanins from Lingonberry on radiation –induced damages; Int.J. Environ. Res. Public Health 2012,9,4732;doi:10.3390/ijerph9124732

4.Ch. Romay,R.Gonzalez,N.Ledon, D. Remirez, V.Rimbau; C-Phycocyanin: A Biliprotein with Antioxidant, Anti-Inflammatory and Neuroprotective Effects; Current Protein and Peptide Science,2003,4,207-216.

5.J.C. Tilak and T.P.A. Devasagayam;Radioprotective and antioxidant properties of Indian Medicinal plant, Terminalia arjuna; BARC Newsletter, Issue No.249,pp167-175.

****

Wadekar 17/7/19

Research Student
(Vaishali Wadekar)

17/7/19

Research Guide
(Prof. C. N. Khobragade)